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Norovirus Leads the Pack:
A Five-Year Look at Enteric Outbreaks in Indiana

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Field Epidemiology Director

Of all outbreaks that the Indiana State Department of Health (ISDH) investigates, enteric (gastrointestinal) outbreaks are the most common. This article will summarize findings from enteric outbreak investigations conducted by the ISDH Epidemiology Resource Center (ERC) and Indiana's local health departments (LHD) from 2000 through September 15, 2004. This summary does not include foodborne complaints investigated by the ISDH Food Protection Program.

Transmission Routes

From 2000 through September 15, 2004, the ISDH ERC investigated 116 enteric outbreaks. In general, enteric outbreaks may be transmitted through contaminated food or beverages, contaminated water, person-to-person contact (particularly in institutional settings), and contaminated surfaces. Figure 1 illustrates the breakdown of transmission routes, either foodborne, person to person, or unknown (no clearly defined mode of transmission). Figure 2 depicts transmission route by season of occurrence.

Figure 1.

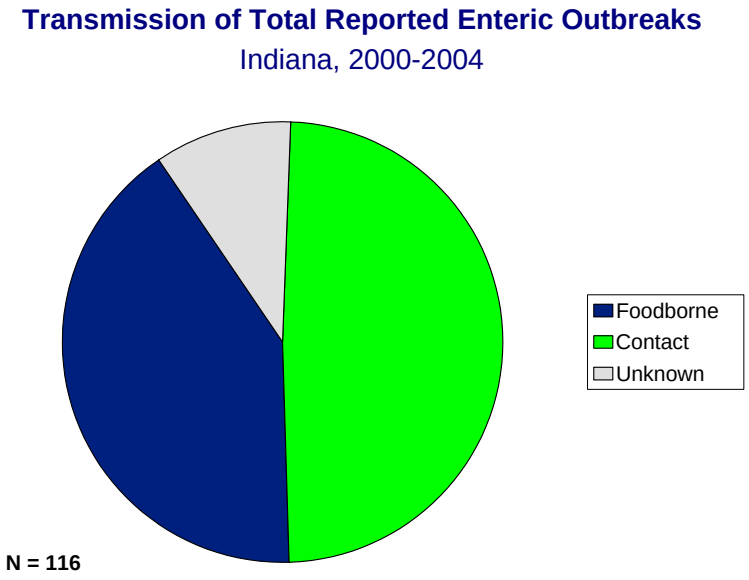
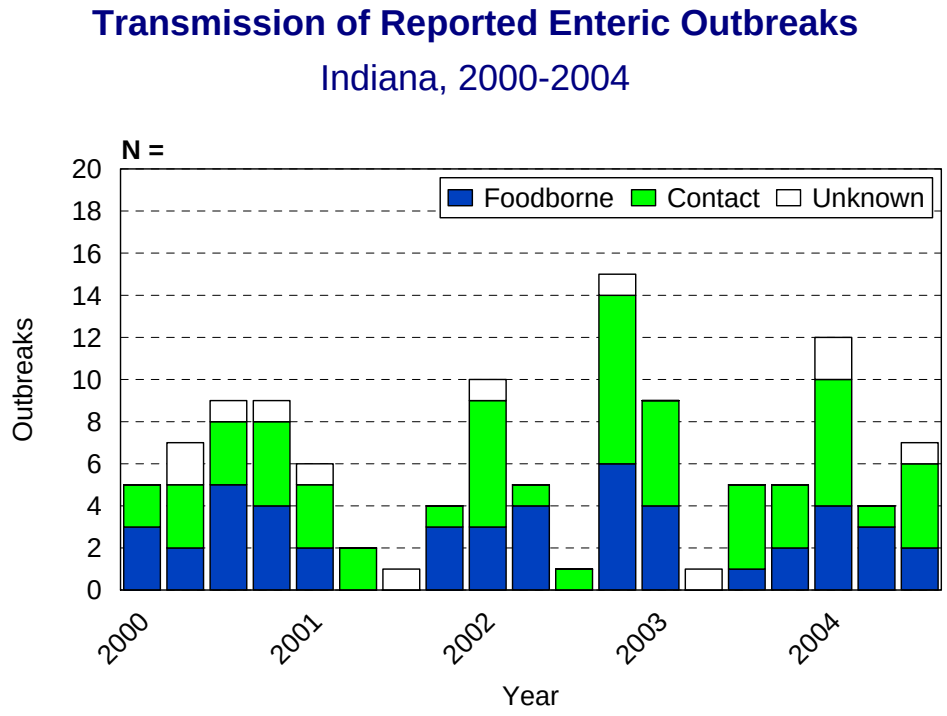


Figure 2.

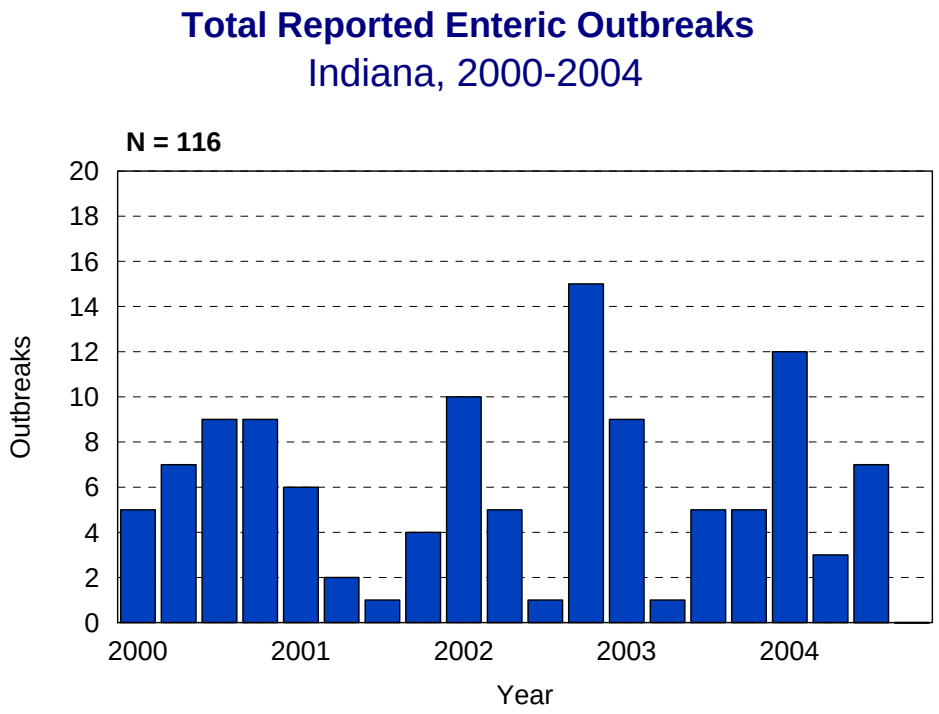


Agents of Illness

Contrary to the popular notion that enteric outbreaks peak during the summer, data show that, in general, enteric outbreaks in Indiana actually peak in the winter, following approximately the same seasonal pattern as influenza (see Figure 3). The reason for this becomes evident when examining the specific agents responsible for illness. Enteric outbreaks may be caused by a variety of agents:

- Bacteria (such as *Campylobacter*, *E. coli* O157:H7, *Salmonella*, *Shigella*, *Clostridium perfringens*, *Bacillus cereus*, and *Staphylococcus aureus*)
- Viruses (such as norovirus and hepatitis A)
- Parasites (such as *Cryptosporidium*, *Cyclospora*, and *Giardia*)
- Toxins (such as mushroom and seafood toxins)
- Chemicals (such as sanitizers, pesticides, and cleaning agents)
- Heavy metals (such as lead, arsenic, and copper)

Figure 3.



Agents are confirmed by laboratory testing of clinical and/or food samples. In the absence of laboratory testing, a specific agent may still be suspected on the basis of the clinical syndrome, incubation period, duration of symptoms, and possible exposure route or vehicle. Figures 4, 5, and 6 depict confirmed and suspected agents for all 116 enteric outbreaks investigated and by transmission route.

Figure 4.

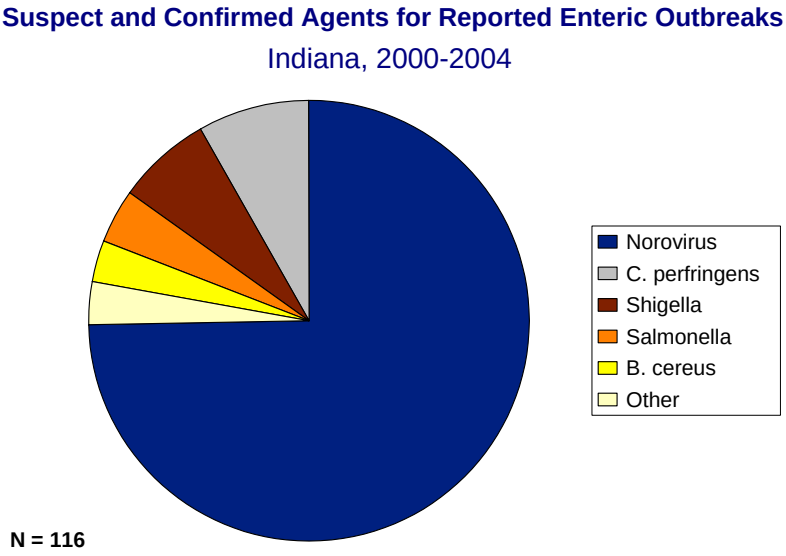


Figure 5.

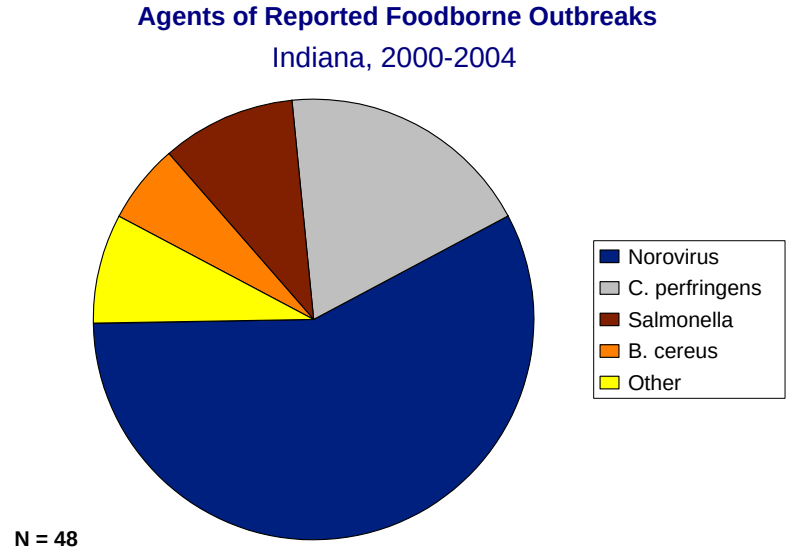
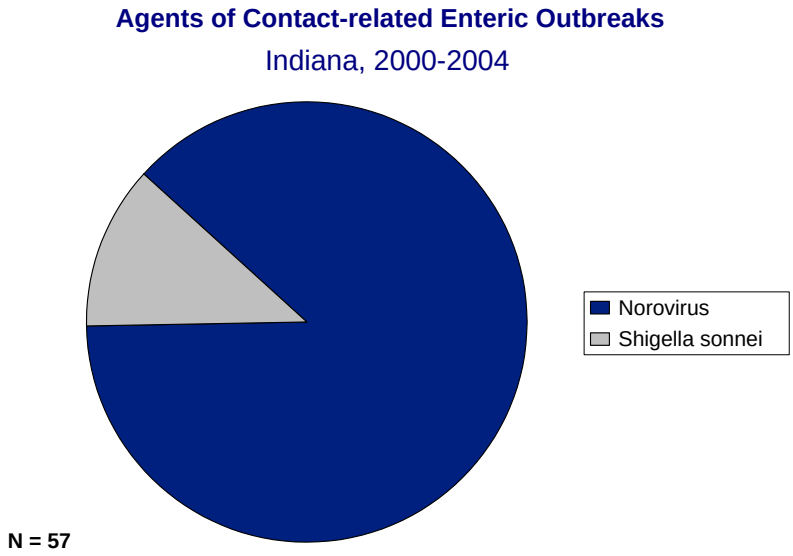


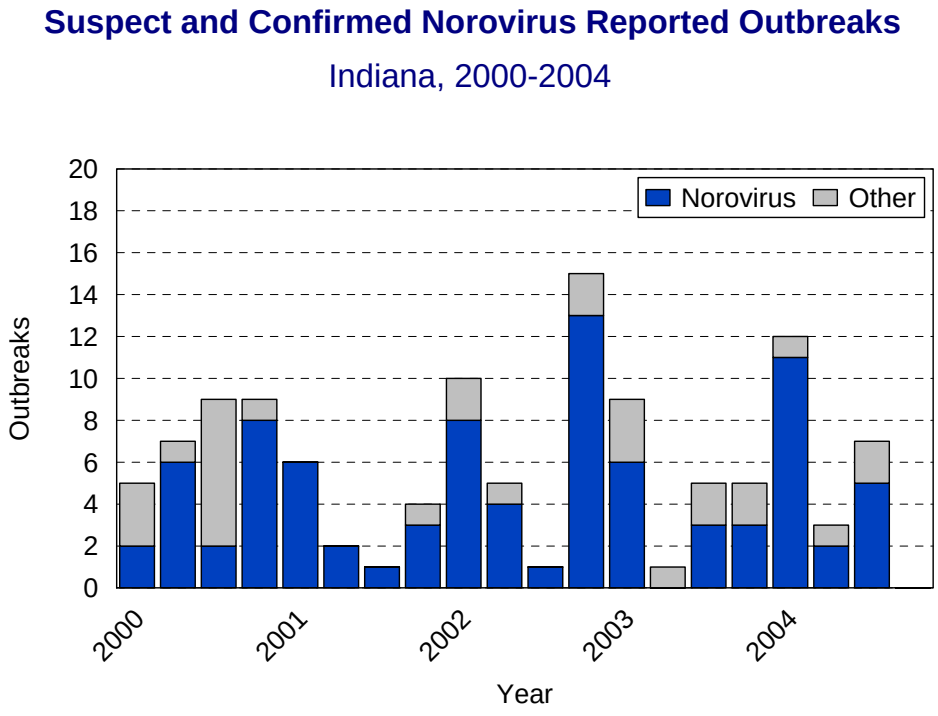
Figure 6.



Impact of Norovirus

Figures 4, 5, and 6 also demonstrate the impact of noroviruses as causative agents of enteric outbreaks in Indiana. This impact is further illustrated in Figure 7, comparing the number of suspected and confirmed norovirus outbreaks against the total 116 enteric outbreaks investigated.

Figure 7.



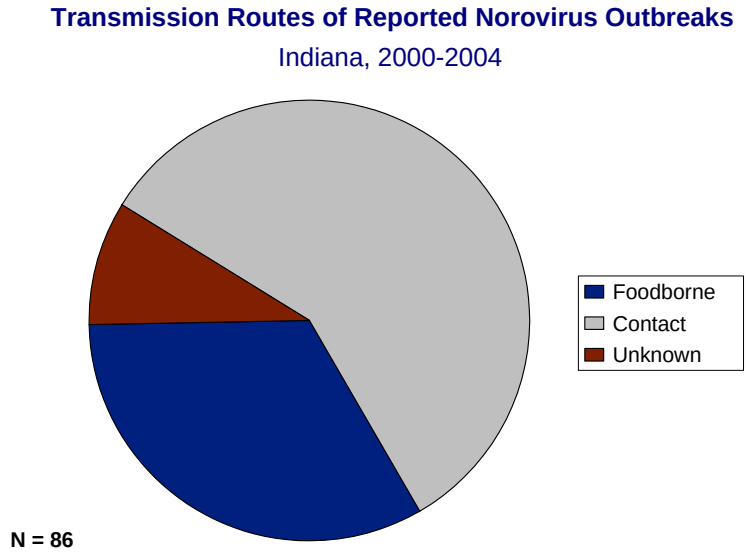
According to the Centers for Disease Control and Prevention (CDC), approximately 23 million cases of noroviral infection occur **each year** in the U.S., or about 1 out of every 12 people. The CDC also estimates that at least 50% of foodborne outbreaks nationwide are caused by noroviruses. As Figures 3 and 4 indicate, approximately 75% of total enteric outbreaks and approximately 60% of foodborne outbreaks from 2000-2004 in Indiana were related to noroviral infection. Although noroviral infection can occur at any time of year, the seasonal peak for infection occurs during the **late fall and winter months**. Figure 7 demonstrates the seasonality of norovirus infection and its impact on enteric outbreak occurrence in Indiana.

Noroviruses pose such a problem for several reasons. First, noroviruses are highly genetically variable, with new strains frequently emerging. For this reason, development of chemotherapeutic treatment or vaccines is unlikely, and none exists presently. The inoculum dose is extremely low (<100 viral particles). Research has shown that those infected with noroviruses can shed virus up to two weeks after symptoms stop, thereby serving as a reservoir to infect others in the absence of clinical illness. Immunity to noroviruses appears to be short-term and dependent on age and overall health of the individual. Due to genetic variability, lack of cross-protective immunity to different strains, and lack of long-term immunity, people can become reinfected.

Environmental stability also contributes to the prevalence of noroviral infection. Noroviruses can remain viable on open surfaces, withstanding ambient temperatures and dryness that would adversely affect viability of other microorganisms. Noroviruses survive freezing, temperatures up to 140°F, and chlorine levels up to 10 ppm.

Noroviruses can be transmitted though a variety of routes, including contaminated food and beverages, contaminated water, person-to-person contact, and contaminated surfaces. Recent research has also indicated that noroviruses may be transmitted via droplets from aerosolized vomitus that have been swallowed. Figure 8 indicates transmission routes determined for suspected and confirmed norovirus outbreaks in Indiana.

Figure 8.



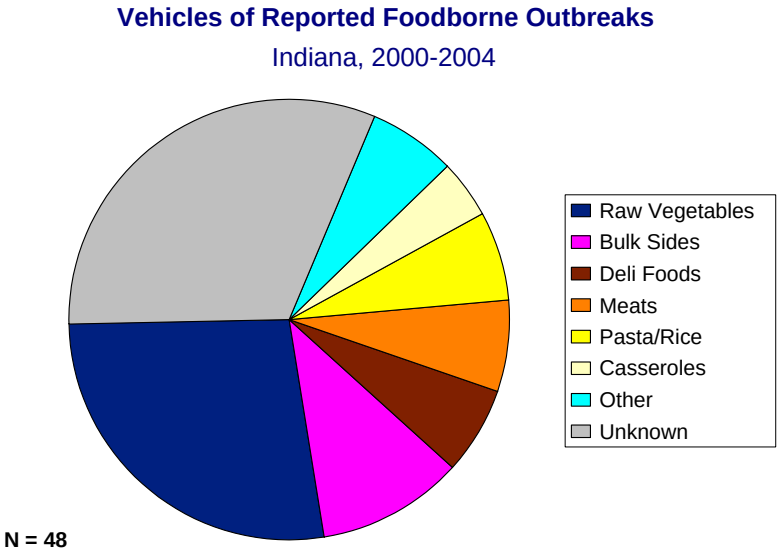
Food Vehicles

In foodborne outbreaks, it is important to identify which particular item(s) may be implicated in order to determine contributing factors and the most effective prevention measures. The most common food vehicles identified in foodborne outbreaks investigated during 2000-2004 are listed below, in order of prevalence:

- Raw vegetables (including lettuce, salad, and salsa)
- Bulk side dishes (including refried beans, stuffing, and mashed potatoes)
- Deli foods (including cold cuts and non-lettuce salads)
- Cooked meats
- Pasta/Rice
- Casseroles (meat or vegetable)
- Other
- Unknown

Figure 9 reflects the occurrence of these items as vehicles for foodborne illness outbreaks from 2000-2004.

Figure 9.

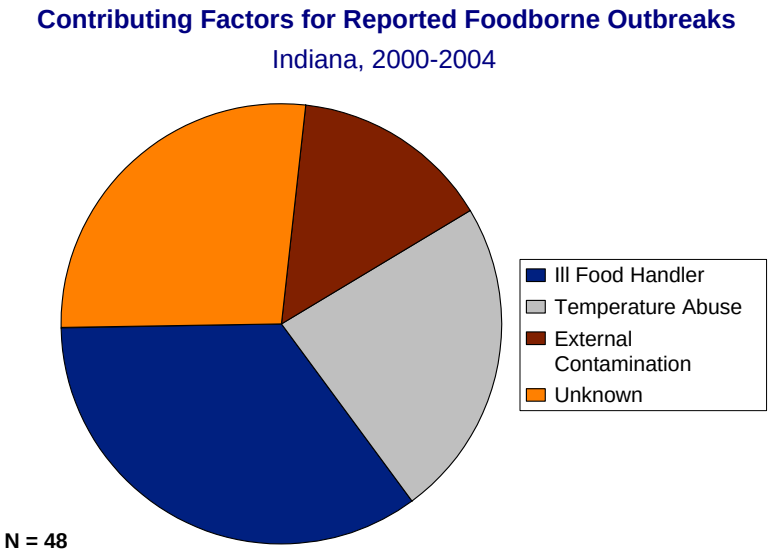


Contributing factors to food contamination included:

- Ill food handlers
- Temperature abuse (such as undercooking, improper thawing, slow cooling, and inadequate reheating)
- External contamination (including cross-contamination and contaminated surfaces)
- Unknown

Figure 10 indicates the occurrence of these factors identified in foodborne outbreaks from 2000-2004.

Figure 10.



Once contributing factors have been identified, the appropriate control and prevention measures can be implemented to stop the spread of illness. To prevent illness transmission among food handlers, thorough and frequent hand washing must be practiced after using the restroom and cleaning soiled areas. Food handlers ill with diarrhea or vomiting should be excluded from work. Requirements for exclusion and readmission to work can be found in the Communicable Disease Reporting Rule for Physicians, Hospitals and Laboratories (410 IAC 1-2.3) and the Retail Food Establishment Sanitation Requirements (410 IAC 7-24). Bare-hand contact with food should be eliminated as much as possible by using utensils or automatic dispensers.

Temperature abuse situations can be avoided by maintaining proper temperatures at critical control points during preparation. These may be found in 410 IAC 7-24. Calibrated thermometers should be used to verify correct temperatures, and commercial food establishments should document temperatures at these control points.

External contamination can be prevented by using separate equipment and preparation surfaces for meats and raw or ready-to-eat foods. Sanitizer levels should be maintained at the proper levels for adequate disinfection. For norovirus outbreaks, a 10% solution of household bleach should be used for soiled surface decontamination and food service items washed through a dishwasher cycle at the appropriate settings. 410 IAC 7-24 now requires all commercial food establishments to employ one person who is a certified food handler (after January 1, 2005). This will help ensure that establishment employees are aware of foodborne illness transmission routes and good food preparation practices.

Future Trends

Are there more enteric outbreaks now than in the past? Perhaps not. There is a greater awareness of foodborne illness, as evidenced by news reports of foodborne illness outbreaks and food recalls. Safe food preparation methods can be found on many food labels. Health hazards associated with eating undercooked foods are commonly included on restaurant menus. Greater awareness can lead to better reporting of outbreaks by the medical community and the general public. Improved laboratory testing, such as methods for detecting norovirus and genetic fingerprinting to identify related bacterial strains, can also help detect outbreaks that may have previously remained unidentified. Since July 2004, Indiana schools are legally required to notify LHDs of absenteeism rates of 20% or higher. This allows much more rapid identification of enteric (or any) outbreaks in schools that, again, may have previously been unidentified.

Are there more enteric outbreaks now than in the past? Perhaps there are. New agents and strains of existing agents, such as norovirus and *E. coli* O157:H7, are emerging. Antibiotic resistance is increasing with bacterial agents such as *Salmonella* and *Shigella*. The U.S. now relies on more food imports to maintain the public's taste for fresh fruits and vegetables year-round, as well as increasing appetites for more "exotic" foods. This allows for the possibility of agents previously unseen in the U.S., such as *Cyclospora*, or agents with low incidence, such as hepatitis A virus, to cause illness. Increased international travel also allows the importation of disease agents into the U.S. The recent increased trend for eating out allows greater potential for infected food handlers or breaches in food-handling practices to affect greater numbers of people.

Whether or not there are more enteric outbreaks now than in the past, all enteric outbreaks must be investigated promptly. The seemingly innocuous phone call received about someone becoming ill after eating at an establishment or event or attending a certain school or daycare may represent just the tip of the iceberg. To report an enteric outbreak, please contact the District Field Epidemiologist or Lee Bray, ISDH Enteric Epidemiologist, at 317-234-2808 as soon as possible.

References

Norovirus: Technical Fact Sheet. Centers for Disease Control and Prevention, January 2003. http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-factsheet.htm

Centers for Disease Control and Prevention. "Norwalk-like viruses:" public health consequences and outbreak management. MMWR 2001;50 (No. RR-9):[1-8].

Jerry Burkman, R.N., M.P.H.
ISDH Division of HIV/STD

Global HIV and AIDS

World AIDS Day is celebrated each year on December 1. This year's campaign is focused on women. In parts of the world where heterosexual transmission is the dominant mode of transmission, the impact of HIV and AIDS is severe. In sub-Saharan Africa, women are 30% more likely to be infected with HIV than men. Population-based studies show that African women ages 15-24 are 3.4 times more likely to be infected than their male counterparts.

The impact of HIV, and its later stage called AIDS, is growing in many parts of society and worldwide. Some of the risks include multiple sex partners among men, culturally acceptable violent or forced-sex situations, other sexually transmitted diseases, and lack of condom use. The impact on society includes premature death, especially for those ages 20-30, absence of family caretakers, orphans, lower family income, lack of food production due to absence of agricultural workers, increased medical care costs, decrease in education attainment due to decrease of available teachers and students, decrease in available health care providers, decrease of community support programs due to lack of resources, and stigma attached to HIV- and AIDS-affected families. Lack of exportable goods also impacts the economy of the villages, towns, and countries and potentially other countries that trade with heavily HIV-impacted countries. The public sector that supports infrastructure has also been hit hard due to illness and death among the workers.

HIV is not only affecting Africa in these areas. Asia, the Caribbean, Latin America, Western Europe, Eastern Europe, South and South-East Asia, and Oceania are also realizing that HIV is spreading rapidly and impacting every aspect of life. Global estimates of adults and children living with HIV and AIDS as of the end of 2003 are between 34.6 and 42.3 million. Adult women account for 47.6% of the adults estimated to be living with this disease. An estimated 2.1 million children are living with HIV disease. This does not include orphans who are not infected. Newly diagnosed infections in 2003 worldwide are estimated to be between 4.2–6.3 million.

United States HIV and AIDS 

The estimate for the number of people living with HIV disease in the United States by the end of 2003 is 351,614, an increase of 1%. This appears to be a fraction of the cases worldwide. Nonetheless, the impact has been heavy in many of the same areas. Those affected are also the young, who are productive in the workplace and provide family care. The advanced treatment that is available in the United States has slowed the diagnosis of AIDS in the 25-34 age group and older age groups.

Adult or adolescent women represent 25% (87,940) of those living with HIV disease in the United States. The adult or adolescent females most impacted by HIV disease are black, both African American and African. They represent 66% of the adult or adolescent females living with HIV disease. White women represent 22%, and Hispanic women represent 10%. Asian, Pacific Islander, American Indian, and Native Alaskan women represent less than 500 persons each.

The most common mode of transmission of HIV among males who are living with HIV disease in the United States is male-to-male transmission (70%), followed by sharing injection works (23%), and heterosexual contact with an HIV-infected person (13%). For females, the most common mode of transmission is heterosexual contact (73%), followed by sharing injection drug works (25%). Other modes, chiefly transfusions of blood and blood products, and tissue transplants, are about 1%. Due to appropriate medications and adherence to treatment regimens, there are approximately 3,000 persons still living who contracted HIV via contaminated blood and tissue.

In the United States, 524,060 persons are estimated to have died with AIDS. The immediate cause of death may not have been complications of AIDS, but these individuals were diagnosed with AIDS at the time of death. Some have also died in accidents, homicide, suicide, chronic diseases, etc.

The AIDS rate per 100,000 citizens in the United States in 2003 was 15.0.

Indiana HIV and AIDS

Indiana has been impacted less by HIV disease than much of the United States, but the areas of life that are changed by this disease are the same.

The AIDS rate per 100,000 citizens in Indiana in 2003 was 8.2. The rates for neighboring states were: Illinois, 13.7; Kentucky, 5.3; Ohio, 6.8; and Michigan, 6.7. Like the rest of the country, HIV disease is more prevalent in metropolitan areas, but it has been diagnosed among residents of all 92 counties in Indiana.

The age groups diagnosed with HIV disease in Indiana have not changed as much as in the United States. The diagnosis rate of those ages 15-24 has remained steady at about 9.5% of the diagnoses per year since 2000. For those ages 25-34, the rate has decreased slightly from 8.6% to 7.2% of those diagnosed per year. For those ages 35-44 the rate has increased from 8.3% to 10.7%, then declined to 9.9% in 2003. The largest change in 2003 was for those ages 45-54; that rate increased from 9.5% in 2000 to 12.2% in 2003.

As of September 2004, Indiana adult and adolescent women account for 18% of those living with HIV disease as of September 2004. This is significantly different from the rest of the United States. The women most impacted by HIV disease in Indiana are African American or African. They represent 49.5% (635) of the women living with HIV disease. In Indiana, the rate for white females is not significantly different at 45.8% (587). There are 52 Hispanic women and 8 women of other races impacted by HIV disease.

The most common mode of transmission of HIV among Indiana males who are living with HIV disease is male-to-male transmission (70%), followed by sharing injection works (8%) and heterosexual contact with an HIV-infected person (6%). For females, the most common mode of transmission is heterosexual contact (62%), followed by sharing injection drug works (15%).

In Indiana 3,955 persons have died with a diagnosis of HIV or AIDS. As described nationwide, they may not have died because of AIDS or complications of AIDS.

PHESS Starts in Indiana

By Linda Jones
ISDH Syndromic Surveillance Epidemiologist

The Indiana State Department of Health (ISDH) has made recent progress in the quest to receive patient data transmitted electronically (in the form of "chief complaints") directly from hospital emergency departments to the ISDH. As projected, these chief complaints will serve as indicators to detect a public health emergency or bioterrorist event before such an event is confirmed by diagnosis or overt activity. This hospital emergency department patient information comprises a major part of the state syndromic surveillance system, called PHESS (Public Health Emergency Surveillance System).

Emergency departments (ED) from five Indianapolis hospital systems (14 individual hospitals) now transmit chief complaints electronically to the ISDH daily. These hospitals represent the first step in a pilot program to test electronic transmission of patient data for the new syndromic surveillance system.

The pilot program will include an additional 19 hospitals (approximately two in each of the 10 Public Health Preparedness Districts), which will each submit electronic patient data to the ISDH by the end of January 2005. When these additional hospitals are brought into the system, patient chief complaints will be transmitted to the ISDH from a total of 33 pilot hospitals. Projections include that the chief complaint information will be added to other currently received information (such as over-the-counter drug sales and Indiana Poison Center reports) in PHESS for a more integrated monitoring and alert system.

PHESS will employ aspects of design and analysis gleaned from major universities (and other centers) across the country, such as Harvard, Pittsburgh, and Carnegie-Mellon. For example, PHESS will use a chief complaint coder, or CoCo, developed by the University of Pittsburgh. CoCo codes symptoms into syndrome categories, including respiratory, gastrointestinal, neurological, and others. This analysis program identifies probabilities (based on historical information) that predict that a particular chief complaint entered by a nurse or physician into the ED record will fit into a specific syndrome category. Syndrome categories will then be analyzed by location and time of occurrence to determine if "clusters" above normal thresholds are occurring. An alert and response program will be developed.

The ISDH will use (and potentially modify) programs in the public domain developed by major universities and centers across the country. Examples include AEGIS (Automated Epidemiologic Geotemporal Integrated Surveillance), and SATSCAN (Spatial and Space Time-Series Spacial Scan Statistic) developed at Harvard; and WSARE (What's Strange About Recent Events), developed at Carnegie Mellon University. ISDH staff plan to use and modify a variety of these programs to develop a system that reflects the "best thinking" in the country for Indiana.

For questions or comments, contact Linda Jones, ISDH Syndromic Surveillance Epidemiologist, at ljones@isdh.state.in.us.

Staffing Changes to ERC, PHPERD

Gary Couch joined the ISDH Public Health Preparedness and Emergency Response Division (PHPERD) on November 8 as a program director E5. A retired Colonel with the Indiana National Guard, Gary was formerly the Director of Plans, Operations and Training for the Military Department of Indiana, and has training in national security, counterterrorism, and civil emergency management. Gary will oversee the preparedness and response activities for Focus Area A of the federal bioterrorism grant and supervise the district public health coordinators. He will be stationed at 2 North Meridian with an office on 6 Selig. Gary may be reached at gcouch@isdh.state.in.us.

Shawn George joined the PHPERD on November 8 as the Public Health Coordinator for District 1. She has experience working in hospitals, private laboratories, and with the American Red Cross. Shawn will be based at the District 1 office in Lake County and will assist local health departments in Jasper, Lake, LaPorte, Newton, and Porter counties. Shawn may be reached at sgeorge@isdh.state.in.us.

Deb Hopseker, formerly the field supervisor with the ISDH Immunization Program, joined the PHPERD as the Public Health Coordinator for District 6 on November 8. Deb will be based at the District 6 office in Delaware County and will assist local health departments in Blackford, Delaware, Fayette, Grant, Henry, Howard, Jay, Madison, Randolph, Rush, Tipton, Union and Wayne counties with preparedness planning and funding issues. Deb may be reached at dhopseke@isdh.state.in.us

Becky Lair, formerly the Public Health Coordinator for District 5, became the District 9 Public Health Coordinator on October 25. Becky will assist local health departments in Clark, Dearborn, Decatur, Floyd, Franklin, Harrison, Jefferson, Jennings, Ohio, Ripley, Scott and Switzerland counties with preparedness planning and funding issues. Becky may be reached at rlair@isdh.state.in.us.

Catherine Went joined the PHPERD as the Public Health Coordinator for District 4 on November 8. She most recently worked for the Area IV Agency on Aging in Lafayette as an HIV Care Coordination Program Manager. Catherine will be based at the District 4 office in Tippecanoe County and will assist local health departments in Benton, Carroll, Cass, Clinton, Fountain, Montgomery, Tippecanoe, White and Warren counties. Catherine may be reached at cwent@isdh.state.in.us.

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Hans Messersmith, Director of the Surveillance and Investigation Unit in the ISDH Epidemiology Resource Center (ERC), left the ISDH on November 5 to pursue an opportunity as a research coordinator for evidence-based medicine at McMaster University in Hamilton, Ontario. Hans began his ISDH career in 1990 with the Indoor Air and Radiological Health program as an environmental scientist. In 2000 he joined the Maternal and Child Health program as the data team chief. He joined the ERC in 2001 as an epidemiologist, and became the Director of the Surveillance and Investigation Unit in 2003.

During his tenure as Director of the Surveillance and Investigation Unit, Hans coordinated the epidemiology and surveillance activities for Focus Area B of the federal bioterrorism grant as well as administering the federal Epidemiology and Laboratory Capacity Grant. He also contributed his skills and expertise to investigations of monkeypox, SARS, and dozens of other outbreaks. Hans has helped create several informational technology programs to benefit the ERC, including a reportable disease electronic surveillance system, an outbreak data management system, and a web site management tool for the upcoming ISDH Communicable Disease Manual. He also has spearheaded the ISDH syndromic surveillance program, which will provide invaluable data to alert the ERC about potential public health crises. We wish him and his family well and we will greatly miss him.

OUTBREAK SPOTLIGHT….

"Outbreak Spotlight" is a regularly appearing feature in the *Indiana Epidemiology Newsletter* to illustrate the importance of various aspects of outbreak investigation. The event described below illustrates how a seemingly routine complaint may be an indication of a much larger situation.

The Tip of The Iceberg (Lettuce)

Sandy Gorsuch
Field Epidemiologist
ISDH Epidemiology Resource Center

Background

On February 6, 2004, the Tippecanoe County Health Department (TCHD) notified the Indiana State Department of Health (ISDH) that two separate callers reported possible foodborne illness. On February 3, one caller reported that she and two coworkers ate lunch at Restaurant A on Friday, January 30, and became ill on Sunday, February 1, with vomiting and diarrhea. According to the complainant, all three patrons ate mesquite chicken salad with various dressings. On February 5, the TCHD received a second telephone complaint regarding a patron and eight other people who ate lunch at Restaurant A on Saturday, January 31, 2004. Five people from this party of nine became ill approximately 24 hours later with vomiting and/or diarrhea.

Epidemiologic Investigation

The ISDH and the TCHD initiated a collaborative investigation of this outbreak. A case-control study was conducted in order to describe the outbreak and to determine if the source was food related. A list of menu items was obtained from Restaurant A. The ISDH developed a questionnaire for restaurant patrons and staff to collect demographic information, clinical histories, and exposure histories. A case was defined as any previously healthy patron or staff member who became ill with acute onset of vomiting or diarrhea after consuming food or beverages at Restaurant A on or after January 1, 2004, or any previously healthy person who had direct contact with an ill person, as described above, and subsequently became ill with vomiting or diarrhea. Any Restaurant A patron or staff member who was healthy during the same time frame was eligible to be included as a control. Any Restaurant A patron or staff member who was ill with signs or symptoms that did not include vomiting or diarrhea within the time frame was excluded from the study.

The ISDH and the TCHD conducted telephone interviews with patrons, and the ISDH conducted face-to-face and telephone interviews with restaurant staff. Nineteen people met the case definition, and seven people were identified as controls. To identify additional cases, the ISDH contacted health care providers within Tippecanoe County, and local health departments in Districts 2, 4, and 7 were encouraged to contact health care providers in their Districts. Two cases and two controls were identified as a result of this active surveillance.

The most common signs and symptoms reported by the nineteen cases included vomiting (89.5%), diarrhea (89.5%), and nausea (68%). Other signs and symptoms reported were fatigue, chills, headache, body aches, abdominal cramps, fever (median: 100.6°F), and bloody stool. The median duration of the illness was 24.5 hours (range: 7 hours to 164 hours). The median incubation period of the illness was 33.0 hours (range: 8 hours to 47.5 hours). At least four people consulted a physician, but none was hospitalized overnight. Ten individuals submitted stool specimens for laboratory analysis (see "Laboratory Results").

Statistical analysis of the food indicated lettuce, whether prepared as a lettuce salad or a garnish on a sandwich, was possibly associated with the illness (odds ratio = 7.11, p-value = 0.057221.) Although the p-value is slightly greater than the statistical cutoff of 0.05, the value approaches statistical significance.

Environmental Assessment

Prompted by the initial telephone food complaint regarding chicken salad on February 3, 2004, a TCHD environmental health specialist conducted a routine inspection of Restaurant A on February 4, 2004, and reviewed the preparation of chicken. Critical violations of the Indiana Retail Food Establishment Sanitation Requirements (410 IAC 7-20) included:

- sanitizer in the dish machine measuring (0) ppm;
- an employee using bare hands to touch plate garnishes and to switch bun tops, sliced tomato, and lettuce;
- sour cream measuring between 47° F and 51° F, above the required 41°F limit;
- sliced ham and cheese measuring at 45°F above the required 41°F limit in a refrigerated unit under a microwave oven.

Corrective measures were discussed upon observation of violations. No food specimens were available for laboratory examination.

On February 6, 2004, the TCHD environmental health specialists contacted restaurant management as follow-up to the second complaint and delivered ISDH specimen collection containers to restaurant staff to identify asymptomatic carriers. A follow-up inspection was also conducted. Previous violations identified on February 4 were corrected, but new violations were identified. Critical violations included:

- quaternary sanitizer measured (0) ppm;
- raw beef measured 49°F and marinade measured 51°F, both above the required 41°F limit;
- an employee on front line using the same gloves to handle raw meat and clean dishes;
- the dishwasher person failing to wash hands properly prior to unloading clean dishes.

Corrective measures were discussed upon observation of violations. No food specimens were available for laboratory examination.

On February 11, 2004, the ISDH notified the TCHD that three cases of *Norovirus* had been confirmed from ill restaurant employees (see "Laboratory Results"). TCHD representatives informed restaurant management staff members of the results, faxed information regarding *Norovirus*, stressed the importance of thorough hand washing, recommended disinfecting the entire restaurant using a 50 ppm chlorine bleach-based cleaner, and ordered exclusion of employees exhibiting vomiting or diarrhea from work until symptom free. TCHD representatives also mailed a *Norovirus* fact sheet, which included outbreak control and prevention measures, to over six hundred food establishments in Tippecanoe County.

On February 12, 2004, restaurant management notified the TCHD that the required corrective measures were implemented and requested a new inspection. A TCHD representative requested a written copy of the restaurant's employee illness exclusion and restriction policy. According to management, there was no written policy. However, if employees arrive at work ill, they are sent home. Employees are made aware of this policy during employee orientation.

On February 13, 2004, TCHD and ISDH representatives conducted a third inspection of Restaurant A. A chlorine bleach odor was noted upon entering the restaurant. The restaurant regional manager provided a written employee illness exclusion policy that did not include restriction. Previous violations identified on February 6 were corrected, but two new critical violations were identified, including moldy popguns in the bar, and the bartender using bare hands to dispense fruit garnishes into cups. Corrective measures were discussed upon observation of violations and were corrected that day. Three food samples were collected, including an uncut head of lettuce, a prepared individual lettuce salad, and two cooked rolls. These were submitted to the ISDH Laboratories for analysis (see "Laboratory Results").

On February 26, 2004, in response to a verbal report of laboratory food sample analysis (see Table 1), representatives of the TCHD conducted a review of the restaurant's lettuce preparation procedures. Based on their findings, the TCHD made the following suggestions:

1. Sanitize the sink, lettuce chopper, and slicer before and after each use.
2. Wash hands before putting on gloves each time.
3. Wear gloves when handling lettuce at all stages.
4. Use plastic wrap instead of trash bags containing ice to place on top of washed lettuce.
5. Check plates for cleanliness.

Seven restaurant staff members reported signs and symptoms consistent with *Norovirus* with onset dates between January 22 and February 3. According to reported illness onset dates and the restaurant work schedule for January 30 through February 1, at least two symptomatic employees worked while ill. One employee who was asymptomatic but tested positive for *Norovirus* worked on January 30-31. The employee identified as the index case reported onset on January 22.

Laboratory Results

Five patrons and five restaurant employees submitted stool specimens to the ISDH Laboratories for analysis. All specimens tested negative for *Salmonella*, *Shigella*, *Campylobacter*, and *E. coli* 0157:H7 by culture. All patrons and four employees tested positive for *Norovirus* by reverse transcription-polymerase chain reaction (RT-PCR). One employee tested negative for *Norovirus*.

The ISDH Laboratories do not test food samples for virus, but bacteriological analysis of food samples can serve as a proxy indicator for viral agents and identify a possible vehicle of transmission. Three food samples were submitted for laboratory analysis (see Table 1). The lettuce salad aerobic plate count was 28 million cfu/g, (normal limit = less than 100,000 cfu/g), and the total coliform count was greater than 1100 MPN/g (normal limit = 100 MPN/g), unfit for human consumption. The uncut head of lettuce and cooked rolls tested within normal limits.

The ISDH Food Protection Program Report of Food Sample Analysis Results indicated that the high aerobic plate count and coliform count for the sample of the prepared individual lettuce salad suggested possible temperature abuse, mishandling and/or inadequate hand washing, and recommended that the TCHD review lettuce preparation procedures with management. This supported the hypothesis that the ready-to-eat prepared individual lettuce salad was a possible vehicle of transmission of *Norovirus*.

Conclusion

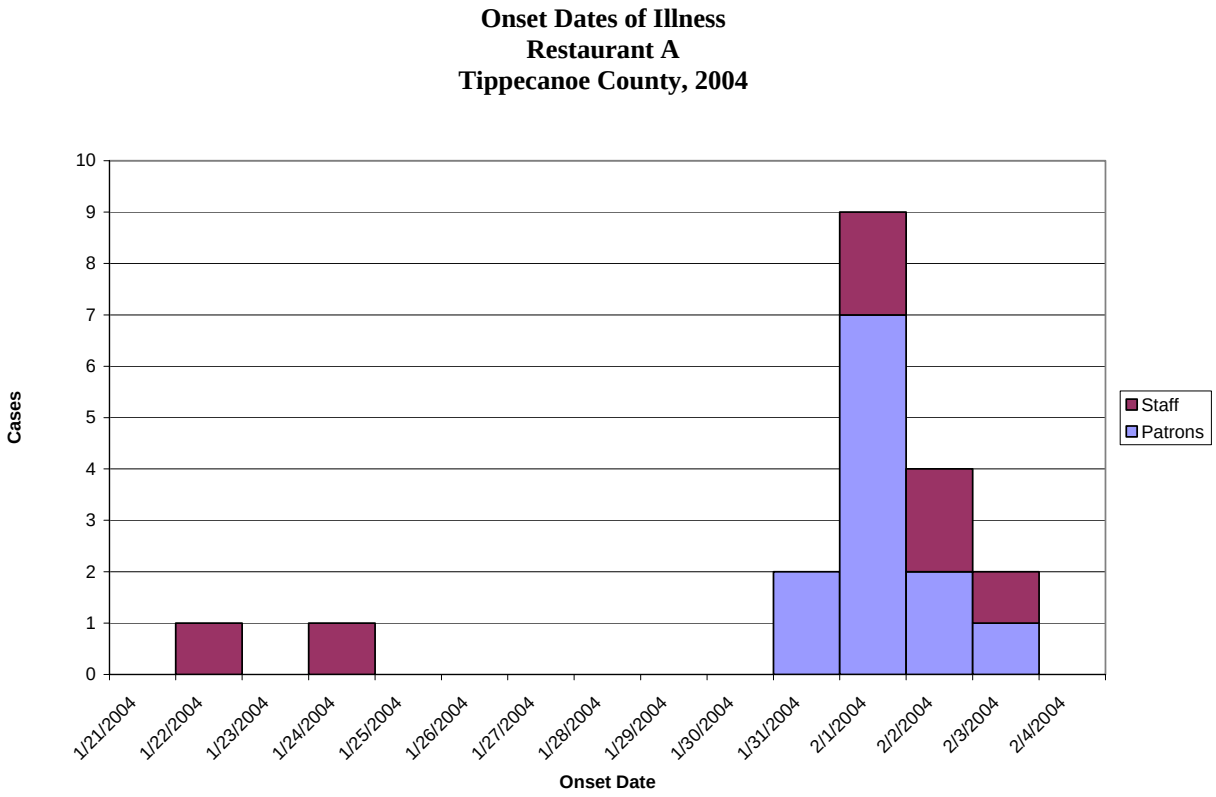
This investigation confirms that an outbreak of gastroenteritis occurred at Restaurant A from at least January 22 through February 3, 2004. Nineteen cases were identified. Since the restaurant is located near Interstate 65, it was possible for patrons from many locations to be exposed and subsequent cases not reported. Some of the 19 cases were reported from neighboring counties.

The causative agent of this outbreak was *Norovirus.* The sudden, acute onset of predominant signs and symptoms (vomiting, diarrhea, and nausea), incubation period (median: 33 hours), and duration of symptoms (median: 24.5 hours) reported in this investigation are typical of *Norovirus* outbreaks. Vomiting, watery non-bloody diarrhea, abdominal cramps, nausea, and occasionally a low-grade fever are the most common signs and symptoms of *Norovirus* infection.[1] Nine of the ten stool specimens submitted tested positive for *Norovirus* (see "Laboratory Results"). In addition, stool specimens were negative for common bacterial agents.

Norovirus can be transmitted in three ways: fecal-oral (through eating or drinking fecally contaminated food, liquid or ice), touching a contaminated object or environmental surface and subsequently placing the contaminated hand in one's mouth, or person to person through contact with an infected person.[2] Evidence also suggests transmission may occur from aerosolized infected vomitus droplets that contaminate environmental surfaces and/or fomites, or are swallowed.[2] *Norovirus,* which is shed in stool, is highly contagious and has an infectious dose of less than 100 viral particles.[1] Viral shedding in the stool may occur before symptoms start, but usually begins with onset of symptoms and may continue for at least two weeks after recovery.[2] In this investigation, the known index case tested positive for *Norovirus* 14 days after recovery from the last reported symptom (upset stomach) and 20 days after vomiting and diarrhea subsided. Studies indicate 30% of *Norovirus* infections are asymptomatic.[2] Although the virus does not multiply outside of the human body, it can survive on environmental surfaces, survive up to 10 ppm of chlorine (above levels recommended for swimming pools and public water systems)[1], survive freezing, and survive temperatures to 140°F.

Evidence indicated that this outbreak was foodborne. Foodborne transmission occurs when an infected food handler with inadequately washed hands fecally contaminates food, liquid or ice during preparation. The epidemic curve (Figure 1) reflects a common source outbreak with at least one known probable secondary exposure. Four employees, including one who was asymptomatic, tested positive for *Norovirus.* In addition, three other employees met the clinical case criteria. This indicates there was a background of illness at the restaurant. Although some employees may not customarily prepare food, they often shake hands with patrons, handle menus, money, receipts, and touch patrons' plates when food items need to be "re-cooked." The presumed index case with a reported onset on January 22 reported handling patron plates for "re-cooks" the morning of January 22, 2004.

Figure 1.



Food vehicles with greatest risk of *Norovirus* transmission include ready-to-eat or cold foods that require no subsequent cooking or are extensively handled after cooking (e.g., salads, vegetables, bakery items, sandwiches), liquid foods in which virus can uniformly mix (e.g., salad dressing, icing), and shellfish from contaminated waters. The most likely vehicle for infection transmission in this outbreak was lettuce. Lettuce, whether consumed in a prepared individual lettuce salad or on a sandwich, approached statistical significance. No other food vehicle approached significance. The known index case reportedly ate a prepared individual lettuce salad and exhibited onset of first symptoms 19 hours later.

Laboratory analysis also indicated that the lettuce was the most likely vehicle. The prepared salad exhibited an exceedingly high aerobic plate count and high coliform count. Lettuce, the main ingredient of the salad, may have been a possible vehicle of transmission for those persons who ate lettuce on their sandwiches. One of the two patrons who reported not eating lettuce or salad tested positive for *Norovirus.* Food histories of the seven controls indicated three ate salad on the same dates as identified cases. However, it is not uncommon for contaminating agents to be unevenly distributed in food. The general manager reported lettuce for the salad was prepared twice daily and unused salad was discarded at the end of each day. Therefore, it was possible that only some salads were contaminated if they were prepared by different employees.

Table 1.

ISDH Laboratory Food Sample Bacteriological Analysis Report
Restaurant A, Tippecanoe County
March 1, 2004

Food Item	Petri film APC*	Total Coliforms	*E. coli*
Individual Lettuce Salad	28,000000 cfu/g	>1100 MPN/g	<3.0 MPN/g
Uncut Head of Lettuce	34,000 cfu/g	<3.0 MPN/g	<3.0 MPN/g
Cooked Rolls	140 cfu/g	<3.0 MPN/g	<3.0 MPN/g

coliforms: normal = 100 MPN/g
cfu = colony forming units
MPN = most probable number

Foodborne outbreaks caused by *Norovirus* can be prevented by strictly adhering to the following food safety and prevention measures:

1. Thoroughly wash hands with soap and clean running water for at least 20 seconds before preparing or serving food, between changes in job duties, after using the restroom, before eating, and after cleaning the restroom. Dave Drinan, MS, R.E.H.S, TCHD Chief Food Service Specialist, offered the following hand-washing recommendations:

    a. Above kitchen hand sinks and restroom sinks used by employees, install an automatic timer with a button that can be activated by employees before starting to wash their hands preset to stop after at least 20 seconds.
    b. Access the web site www.handwashingforlife.com to obtain multi-language posters that can be placed above kitchen hand sinks and restroom sinks, and PowerPoint presentations to educate employees.

2. Thoroughly wash all fruits and vegetables before serving, especially if served raw.
3. Maintain a hot holding temperature of 140ºF for potentially hazardous food.
4. Thoroughly clean and disinfect environmental surfaces with a 50 ppm chlorine bleach-based cleaner, particularly surfaces of kitchen equipment, utensils, containers, and sinks used for preparing fruits, vegetables, and potentially high-risk food.
5. Wash restaurant linens in a washing machine at maximum cycle length with hot water and detergent, followed by machine drying.
6. Exclude all food handlers from working while ill with diarrhea and/or vomiting.

References

1. "Norwalk-Like Viruses" Public Health Consequences and Outbreak Management. Centers for Disease Control and Prevention. *MMWR*, June 1, 2001 / 50(9);1-17.

2. Norovirus: Q & A. January 2003. Centers for Disease Control and Prevention web site, http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus-qa.htm

Training Room

Indiana State Department of Health
Immunization Program Presents:
"Child and Adolescent Immunizations from A to Z"

The ISDH Immunization Program and Health Educators are offering this free, one-day educational course on all aspects of immunization practices. Topics include:

- Principles of Vaccination
  - Overview of the immune system
  - Classification of vaccines
- An overview of Vaccine-Preventable Diseases
- General Recommendations on Immunization
  - Timing and spacing
  - Contraindications and precautions to vaccination
- Safe and Effective Vaccine Administration
  - Prior to administration
  - Administration
  - Documentation and reminder/recall
  - Adverse Events
- Safe Vaccine Storage and Handling
- Indiana Requirements
  - Schools
  - Daycare/Head Start
  - Exemptions
- Tools to Read Immunization Records
- Vaccine Misconceptions
  - MMR and autism
  - Thimerosal and mercury
  - Overloading the immune system
  - Influenza vaccine
- Reliable Resources

This course is designed for all immunization providers and staff. Presentation of this course takes six hours or can be customized to provide the components needed for your office or clinic staff. A training manual and certificate of attendance are provided to all attendees.

Courses are held throughout Indiana about four times per month (see schedule next page). All persons involved in immunizations are encouraged to attend a course in their area. Registration is required. To attend or schedule/host a course in your area, or for more information on "Child and Adolescent Immunizations from A to Z" and other immunization education opportunities, please contact Beverly Sheets by calling (317) 501-5722 or e-mail hepbbev@aol.com.

CALENDAR 2004 "IMMUNIZATIONS FROM A TO Z"

Dec. 1, 2004 "Immunization A-Z", IUMG, Indianapolis (FULL)

Dec. 3, 2004 "Immunization A-Z" ISDH Rice Auditorium, 9AM- 3PM

Dec. 9, 2004 "Immunization A-Z" Elkhart General Hospital, 9AM-3 PM

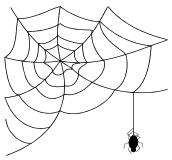
NOTE: There is no charge for any of these events.

NOTE: You must register for these events. Training materials are provided.

Contact Beverly Sheets at 317-501-5722 or hepbbev@aol.com for further information and to schedule "Immunizations From A-Z" and other immunization events in your area.

NOTE: There is NO CHARGE for any of these events.

YOU MUST REGISTER for these events. Training materials are provided.



Wonderful Wide Web Sites

ISDH Data Reports Available

The ISDH Epidemiology Resource Center has the following data reports and the Indiana Epidemiology Newsletter available on the ISDH Web Page:

http://www.in.gov/isdh/dataandstats/data_and_statistics.htmT

Indiana Cancer Incidence Report
(1990, 95, 96, 97, 98, 99)

Indiana Cancer Mortality Report
(1990-94, 1992-96, 1999)

Indiana Health Behavior Risk Factors
(1999, 2000, 2001, 2002)

Indiana Health Behavior Risk Factors (BRFSS) Newsletter (9/2003, 10/2003, 6/2004, 9/2004)

Indiana Hospital Consumer Guide
(1996)

Public, Hospital Discharge Data
(1999, 2000, 2001, 2002)

Indiana Mortality Report
(1999, 2000, 2001, 2002)

Indiana Natality Report
(1998, 99, 2000, 2001, 2002)

Indiana Induced Termination of Pregnancy Report
(1998, 99, 2000, 2001)

Indiana Marriage Report
(1995, 97, 98, 99, 2000)

Indiana Infectious Disease Report
(1997, 98, 99, 2000, 2001)

Indiana Maternal & Child Health Outcomes & Performance Measures
(1990-99, 1991-2000, 1992-2001)

HIV Disease Summary

Information as of October 31, 2004 (based on 2000 population of 6,080,485)

HIV - without AIDS to date:

345	New HIV cases from November 2003 thru October 2004	12-month incidence	5.67 cases/100,000
3,603	Total HIV-positive, alive and without AIDS on October 31, 2004	Point prevalence	59.26 cases/100,000

AIDS cases to date:

368	New AIDS cases from November 2003 thru October 2004	12-month incidence	6.05 cases/100,000
3,599	Total AIDS cases, alive on October 31, 2004	Point prevalence	59.19 cases/100,000
7,399	Total AIDS cases, cumulative (alive and dead)		

REPORTED CASES of selected notifiable diseases

Disease	Cases Reported in October *MMWR* Week 40-43		Cumulative Cases Reported January - October *MMWR* Weeks 1-43	
	2003	2004	2003	2004
Campylobacteriosis	23	14	405	327
Chlamydia	1,329	1,368	14,179	15,161
E. coli O157:H7	2	3	70	41
Hepatitis A	2	3	54	52
Hepatitis B	5	4	33	38
Invasive Drug Resistant *S. pneumoniae* (DRSP)	10	10	128	122
Invasive pneumococcal (less than 5 years of age)	5	1	46	35
Gonorrhea	573	578	5,511	5,548
Legionellosis	1	1	25	33
Lyme Disease	2	0	20	16
Meningococcal, invasive	1	1	39	18
Pertussis	6	67	55	175
Rocky Mountain Spotted Fever	0	0	2	5
Salmonellosis	24	17	459	391
Shigellosis	4	5	128	172
Syphilis (Primary and Secondary)	4	4	38	46
Tuberculosis	16	17	113	109
Animal Rabies	4 (bats)	0 (bats)	25 (bats)	10 (9 bats and 1 skunk)

For information on reporting of communicable diseases in Indiana, call the *ISDH Epidemiology Resource Center* at (317) 233-7665.

Indiana
Epidemiology
Newsletter

The *Indiana Epidemiology Newsletter* is published by the Indiana State Department of Health to provide epidemiologic information to Indiana health professionals and to the public health community.